

REMARKS

Claims 8 and 18 have been canceled without prejudice, and claims 1, 2, 5 and 7 have been amended. In particular, independent claim 1 has been amended to incorporate the subject matter of dependent claim 18. Therefore, claim 1 now has the same scope as original claim 18.

Independent claims 2, 5 and 7 have been likewise amended to incorporate the subject matter of original claim 18. In addition, claims 2, 5 and 7 have been amended to incorporate the subject matter of claim 8.

The present amendment adds no new matter to the instant application.

The Invention

The present invention relates to a photosensitive element comprising a support film, which comprises a biaxially oriented polyester film and a photosensitive resin composition layer formed on one surface of the polyester film, such as would be used in preparing a resist pattern when manufacturing a printed wiring board. In a first embodiment, in accordance with the present invention, a photosensitive element is provided that comprises a support film which comprises a biaxially oriented polyester film and a photosensitive resin composition layer formed on one surface of the polyester film, wherein a resin layer containing fine particles is formed on the opposite surface of the support film to which the photosensitive resin composition layer is formed, and said photosensitive resin composition comprises (A) a binder polymer having a carboxyl group, (B) a photopolymerizable compound having at least one polymerizable ethylenically unsaturated group in the molecule which mainly comprises a bisphenol A type (meth)acrylate compound, and (C) a photopolymerization initiator including a 2,4,5-triaryl imidazole dimer.

By employing a photosensitive element having these features, certain advantageous requisite characteristics when manufacturing resist patterns, such as excellent side wall flatness of a resist pattern, resolution and adhesiveness, can be satisfactorily achieved. In other words, for the reasons provided below, a photosensitive element of the present invention, which has a photopolymerizable compound having at least one polymerizable ethylenically unsaturated group in the molecule, which mainly comprises a bisphenol A type (meth)acrylate compound is an improvement over photosensitive elements of the prior art, which do not have such a photopolymerizable compound.

The Rejections

Claims 1-16 and 18-40 stand rejected under 35 U.S.C. §103(a) as unpatentable over Sato (U.S. Patent 5,648,159) in view of Kimura et al. (U.S. Patent 6,207,345).

Applicants respectfully traverse the present rejection and request reconsideration and allowance of the claims for the following reasons.

Applicant's Arguments

A patentability analysis under 35 U.S.C. § 103 requires (a) determining the scope and content of the prior art, (b) ascertaining the differences between the prior art and the claimed subject matter, (c) resolving the level of ordinary skill in the pertinent art, and (d) considering secondary considerations that may serve as indicia of nonobviousness or obviousness. Graham v. John Deere Co. of Kansas City, 148 U.S.P.Q. 459, 467 (1966). Furthermore, a proper rejection under Section 103 further requires showing (1) that the prior art would have suggested to a person of ordinary skill in the art that they should make the claimed device or carry out the claimed process, (2) that the prior art would have revealed to a person of ordinary skill in the art that in so making or doing, there would have been a reasonable expectation of success, and

(3) both the suggestion and the reasonable expectation of success must be found in the prior art and not in the applicants' disclosure. In re Vaeck, 20 U.S.P.Q.2d 1438, 1442 (Fed. Cir. 1991).

The Sato Patent

U.S. Patent 5,648,159 to Sato (hereafter the Sato Patent) teaches a dry resist, which is used in production of printed microcircuits and usually is a laminated structure composed of a base film, a photoresist layer, and a protective film (col. 1, lines 3-12). Generally, the base film is a polyester film having excellent mechanical and optical properties, chemical resistance, dimensional stability and flatness (col. 1, lines 10-13). The photoresist layer is composed of a photosensitive resin and the protective film is composed of a polyethylene or polyester (col. 1, lines 13-15). In order to provide a base film that satisfies certain properties for transparency, slipperiness, and air leak, the Sato Patent teaches a biaxially oriented laminated polyester film made from an aromatic dicarboxylic acid or an ester thereof in combination with a glycol, such that the resin produced has not less than 80% of the recurring structural units being ethylene terephthalate or ethylene-2,6-naphthalate units (col. 1, lines 47-65, and col. 2, lines 12-48). The surface layer of the biaxially oriented laminated polyester base film includes a resin containing particles having an average particle diameter of 0.01 to 3.0 μm (See Abstract, and col. 2, lines 61-66). The photoresist layer is formed on the surface opposite the outermost surface layer of the base film, and the protective layer is formed on the photoresist layer (col. 2, lines 22-24).

The Sato Patent also teaches photoresist compositions including: methyl methacrylate/acrylonitrile/acrylated glycidyl acrylate copolymer; methyl methacrylate/2-hydroxyethylacrylate copolymer; triethylene glycol acetate; tert-butylanthraquinone; 2,2'-methylene-bis(4-ethyl-6-tert-butylphenol); ethyl violet and methyl ethyl ketone (col. 8, lines 55-65). No "bisphenol A type (meth)acrylate" compound is disclosed, particularly one

“having at least one polymerizable ethylenically unsaturated group” as recited by claims 1, 2 and 7 of the present application.

As admitted by the Examiner (Office Action dated July 20, 2004, page 3, lines 18, to page 4, line 12), the Sato Patent does not teach, or even suggest, the following: (i) a bisphenol A type (meth)acrylate compound as recited in independent claims 1, 2, 5, and 7; (ii) the “photopolymerization initiator comprises 2,4,5-triaryl imidazole dimer” as recited in claim 1, 2, 5 and 7; (iii) a “weight average molecular weight of ...the binder polymer having a carboxyl group is 20,000 to 300,000” as recited in claim 15; (iv) an “acid value of...the binder polymer having a carboxyl group is 50 to 300 mg KOH/g” as recited in claim 16; (v) the formulation of “Components (A), (B) and (C)” as recited in claim 19; (vi) that the “unevenness on the side surface of the resist pattern is 0 to 3.0 μm ” as recited in claims 24 and 34; (vii) that the “number of unevenness larger than 3.0 μm on the center line of the side surface of the resist pattern is 0 to 5/4 mm” as recited in claims 25 and 35; (viii) that the “average roughness...on the side surface of the resist pattern is 0 to 2.0 μm ” as recited in claims 26 and 36; (ix) a “maximum height...on the side surface of the resist pattern is 0 to 3.0 μm ” as recited in claims 27, 28, 37 and 38; that the “height of the resist pattern is 1 to 150 μm ” as recited in claim 30; and that the “height of the wiring pattern is 0.01 to 200 μm ” as recited in claim 40 of the present invention.

Applicants also assert that the Sato Patent fails to teach, or even suggest, the limitation of claim 7 wherein “(Contact angle at X surface)/(Contact angle at Y surface) > 1.1.”

The Kimura Patent

U.S. Patent 6,207,345 B1 to Kimura et al. (hereafter, the Kimura Patent) teaches a “lamine film and processes for preparing printed wiring board” for manufacturing a

laminate film (1), which includes a support layer (2'), a photosensitive layer (3) coating the support layer, and a coating layer (4') on the photosensitive layer as shown in Figure 2a (col. 1, lines 15-25). The support layer can be a biaxially stretched polyethylene terephthalate film (col. 10, lines 14-17).

The Kimura Patent also teaches that the photosensitive layer is a photosensitive resin composition that contains a carboxyl group-containing binder polymer, a photopolymerization initiator, and a photo-polymerizable vinyl compound as essential components (col. 3, line 58, to col. 4, line 4). The Kimura Patent teaches that the binder polymer preferably has a weight molecular average molecular weight of 10,000 to 500,000 when measured by gel permeation chromatography, and an acid value of solid component of 30 to 300 when alkaline development is carried out (col. 4, lines 5-12). The Kimura Patent teaches various aromatic ketones, benzoin ethers, benzoines, benzil derivatives, 2,4,5-triarylimidazole dimers and/or acridine derivatives may be used as the photopolymerization initiator (col. 4, lines 33-54), and various photopolymerizable vinyl compounds, such as bisphenol A dioxyethylene diacrylate, etc. (col. 4, line 54, to col. 5, line 23).

While the Kimura Patent teaches lists of materials, there is no specific description in the Examples of the Kimura Patent concerning a photosensitive resin composition containing (B) a photopolymerizable compound containing "bisphenol (A) type (meth)acrylate compound" in combination with (C) a photopolymerization initiator including a "2,4,5-triaryl imidazole dimer." Furthermore, the Kimura Patent fails to teach, or even suggest, a film in which a resin layer containing fine particles is laminated to a biaxially oriented polyester film. Therefore, the Kimura Patent cannot teach, or even suggest, "a resin layer containing fine particles is formed on the opposite surface of the support film to which the photosensitive resin composition layer is formed" as recited in claims 1, 2, 5 and 7 of the present invention. Likewise, the Kimura Patent plainly fails to teach the combination of a

photopolymerizable compound containing “bisphenol (A) type (meth)acrylate compound” with a photopolymerization initiator that comprises “2,4,5-triaryl imidazole dimer” and “a resin layer containing fine particles is formed on the opposite surface of the support film to which the photosensitive resin composition layer is formed” as recited in claims 1, 2, 5 and 7 of the present invention.

The Kimura Patent also fails to teach, or even suggest, (i) that the “unevenness on the side surface of the resist pattern is 0 to 3.0 μm ” as recited in claims 24 and 34; (ii) that the “number of unevenness larger than 3.0 μm on the center line of the side surface of the resist pattern is 0 to 5/4 mm” as recited in claims 25 and 35; (iii) that the “average roughness...on the side surface of the resist pattern is 0 to 2.0 μm ” as recited in claims 26 and 36; and (iv) a “maximum height...on the side surface of the resist pattern is 0 to 3.0 μm ” as recited in claims 27, 28, 37 and 38 of the present invention.

Applicants also assert that the Kimura Patent fails to teach, or even suggest, the limitation of claim 7 wherein “(Contact angle at X surface)/(Contact angle at Y surface) > 1.1.”

Summary of the Prior Art

The Sato Patent teaches a dry resist having a biaxially oriented polyester base film, wherein the surface layer of the base film contains particles having an average particle diameter of 0.01 to 3.0 μm . A photoresist layer is formed on the base film, and a protective film covers the photoresist layer. The Sato Patent does not teach, or even suggest, that the photoresist layer formed on the base film would include “bisphenol A type (meth)acrylate” and that the photopolymerization initiator includes a “2,4,5-triaryl imidazole dimer” as recited in independent claims 1, 2, 5 and 7.

The Kimura Patent teaches a laminate film having a base layer, a photosensitive layer, and a coating layer, wherein the base layer may be a biaxially stretched polyethylene terephthalate film and the photosensitive layer may include a bisphenol A (meth)acrylate, such as bisphenol A dioxyethylene diacrylate. However, the Kimura Patent does not teach the “resin layer containing fine particles...formed on the opposite surface of the support film to which the photosensitive resin composition layer is formed” as recited in claims 1, 2, 5 and 7. Furthermore, while the Kimura Patent provides a list of known photopolymerization initiators, which includes 2,4,5-triarylimidazole dimers, the Kimura Patent provides no specific guidance for combining a photopolymerizable compound containing “bisphenol (A) type (meth)acrylate compound” with a photopolymerization initiator that is “2,4,5-triaryl imidazole dimer” on the “resin layer containing fine particles...formed on the opposite surface of the support film to which the photosensitive resin composition layer is formed” as recited in claims 1, 2, 5 and 7 of the present invention.

Applicants assert that neither the Sato Patent, nor the Kimura Patent teach, or even suggest, the following claimed features of the present invention: (i) that the “unevenness on the side surface of the resist pattern is 0 to 3.0 μm ” as recited in claims 24 and 34; (ii) that the “number of unevenness larger than 3.0 μm on the center line of the side surface of the resist pattern is 0 to 5/4 mm” as recited in claims 25 and 35; (iii) that the “average roughness...on the side surface of the resist pattern is 0 to 2.0 μm ” as recited in claims 26 and 36; and (iv) a “maximum height...on the side surface of the resist pattern is 0 to 3.0 μm ” as recited in claims 27, 28, 37 and 38. Therefore, no combination of the Sato Patent and the Kimura Patent can teach all of the subject matter of these claims so the Section 103 rejection standing against claims 24-28 and 34-38 is plainly untenable and must be withdrawn.

Examiner's Inherency Argument

Applicants also assert that the Sato Patent fails to teach, or even suggest, the limitation of claim 7 wherein “(Contact angle at X surface)/(Contact angle at Y surface) > 1.1.” The Examiner contends that because the Sato Patent teaches a photosensitive element that comprises a photosensitive resin layer, that Sato’s photosensitive element would possess the same properties (such as contact angle) as Applicant’s claimed invention (See Office Action, dated July 20, 2004, page 6, lines 4-12). However, the Examiner’s conclusion appears to be based upon an erroneous inherency argument.

When the PTO asserts that there is an explicit or implicit teaching or suggestion in the prior art, the PTO must indicate where such teaching or suggestion appears in the reference. In re Rijckaert, 28 U.S.P.Q.2d 1955, 1957 (Fed. Cir. 1993). When a reference is silent about the asserted inherent characteristic, inherency may not be established by mere probabilities or possibilities, but must be the natural operational result flowing from the disclosure of the reference. Continental Can Co. USA Inc. v. Monsanto Co., 20 U.S.P.Q.2d 1746, 1749 (Fed. Cir. 1991).

In the present case, the Sato Patent is silent with respect to the following ratio:

$$(\text{Contact angle at X surface})/(\text{Contact angle at Y surface}) > 1.1.$$

However, the Examiner asserts that because the Sato Patent and the claims of the present invention both include a photosensitive resin that the layer of photosensitive resin taught by the Sato Patent would “possess the same properties (such as contact angle) as the claimed photosensitive element” (Office Action, dated July 20, 2004, page 6, lines 10-12). On the other hand, the Examiner admits that the photosensitive layer taught by the Sato Patent is different from the photosensitive resin recited in the present claims because the Sato Patent does not teach a photosensitive layer comprising a “bisphenol A type (meth)acrylate

compound” as recited in claims 1, 2, 5 and 7 of the present invention (Office Action, dated July 20, 2004, page 3, lines 18-20).

Having admitted that the “photosensitive resin” of the Sato Patent does not include “bisphenol A type (meth)acrylate,” the Examiner has failed to establish a reason to justify an inherency argument. In other words, a person of ordinary skill in the art would not reasonably conclude that two different types of “photosensitive resin,” one comprising “bisphenol A type (meth)acrylate” and the other without it, would inherently have the same properties, such as contact angle. There is nothing in the Sato Patent to support that the claimed contact angle ratio would be the natural result flowing from the teachings of the Sato Patent. See Continental Can Co. USA Inc. v. Monsanto Co., 20 U.S.P.Q.2d at 1749. Therefore, the Examiner must withdraw the Section 103 rejection standing against claim 7 on the grounds that the Sato Patent does not reasonably teach the claimed contact angle ratio provided by bisphenol A type (meth)acrylate containing resins.

Combination of the Prior Art

For the reasons discussed above, the rejection under 35 U.S.C. § 103(a) standing against claims 24-28 and 34-38 is plainly untenable and must be withdrawn because no combination of the Sato Patent and the Kimura Patent will teach all of the features recited in these claims. Furthermore, the Section 103 rejection standing against claim 7 is untenable because the inherency argument invoked by the Examiner to extend the scope of the subject matter taught by the Sato Patent is clearly erroneous.

With respect to claims 1, 2, 5 and 7, the Examiner’s Section 103 rejection is untenable and should be withdrawn because neither the Sato Patent, nor the Kimura Patent, provides a suggestion grounded in the prior art to justify the combination. See In re Vaeck, 20 U.S.P.Q.2d 1438, 1442 (Fed. Cir. 1991). In particular, the Sato Patent pertains to a dry resist

capable of imparting a high resolution and preventing the occurrence of image fault (col. 2, lines 10-15). The Kimura Patent is directed to a laminate film in which the transfer layer is favorably conformed to the uneven surface of the target on which the transfer layer is laminated to improve resolution and production yield (col. 2, lines 51-53). On the other hand, the object of the present invention is to satisfy all of the required characteristics of the photosensitive element, such as excellent side wall flatness of the resist pattern, resolution and adhesiveness characteristics.

Accordingly, neither the Sato Patent nor the Kimura Patent reasonably provide a suggestion to combine teachings, as the Examiner suggests, that would suggest to a person of ordinary skill in the art to choose a photopolymerizable bisphenol A type (meth)acrylate compound from among the approximately 30 types of photopolymerizable compounds listed by Kimura (col. 4, line 54, to col. 5, line 24) and to choose a 2,4,5-triaryl imidazole dimer photopolymerization initiator from among the six different classes of photopolymerization initiators listed by Kimura (col. 4, lines 33-52), and then to apply this combination to the subject matter taught by the Sato Patent. Because there is no teaching grounded in the prior art to suggest the combination of the photopolymerizable bisphenol A type (meth)acrylate compound and the 2,4,5-triaryl imidazole dimer photopolymerization initiator, the Examiner must rely upon random selection which would produce the combination in about 1 out of 180 times (i.e., .55% probability), and then apply this remote possibility to yet another reference, the Sato Patent.

In other words, not only is there no explicit suggestion grounded in the prior art to combine the references as the Examiner has done, the particular combination of the prior art is not even remotely foreseeable when the probabilities are logically considered.

Conclusion

The Examiner's obviousness rejection under 35 U.S.C. § 103(a) is untenable and should be withdrawn because neither the Sato Patent nor the Kimura Patent teach, or even suggest, the following claimed features of the present invention: (i) that the "unevenness on the side surface of the resist pattern is 0 to 3.0 μm " as recited in claims 24 and 34; (ii) that the "number of unevenness larger than 3.0 μm on the center line of the side surface of the resist pattern is 0 to 5/4 mm" as recited in claims 25 and 35; (iii) that the "average roughness...on the side surface of the resist pattern is 0 to 2.0 μm " as recited in claims 26 and 36; (iv) a "maximum height...on the side surface of the resist pattern is 0 to 3.0 μm " as recited in claims 27, 28, 37 and 38, and (v) wherein " $(\text{Contact angle at X surface})/(\text{Contact angle at Y surface}) > 1.1$ " as recited in claim 7.

With respect to claims 1, 2, 5 and 7, the Examiner's Section 103 rejection is untenable and should be withdrawn because neither the Sato Patent, nor the Kimura Patent, provides a suggestion grounded in the prior art to justify the combination. In fact, when the random selection of components relied upon by the Examiner is approached statistically, the Kimura Patent "suggests" the claimed combination of photopolymerizable compound and photopolymerization initiator with about a 0.5 % probability, which the Applicants contend is an insufficient suggestion to justify the combination of the art as a whole.

For all of the above reasons, claims 1-7, 9-16 and 19-40 are in condition for allowance. Therefore, Applicants respectfully request reconsideration of the application, and a prompt notice of allowance is earnestly solicited.

Questions are welcomed by the below-signed attorney for the Applicants.

Respectfully submitted,
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